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VOLTAGE CORRECTION CIRCUIT OF SECONDARY BATTERY

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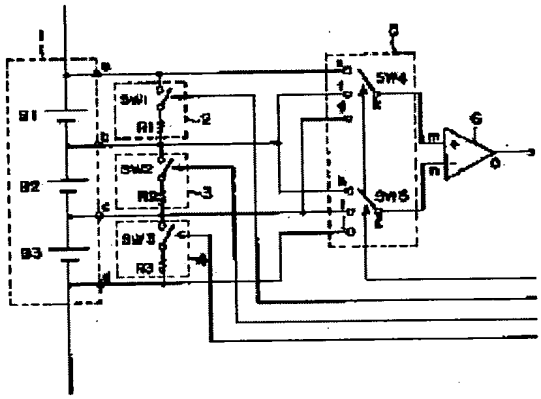
Abstract of **JP11150877**

PROBLEM TO BE SOLVED: To provide the voltage correction circuit of a secondary battery for correcting the voltage difference due to the variations of discharge amount of a plurality of secondary batteries which are connected in series and the scattered in the discharge amount.
SOLUTION: Discharge circuits 2, 3, and 4 that can be turned on or off are connected to each both terminals of secondary batteries B1, B2, and B3, each terminal voltage of the batteries B1, B2, and B3, is measured by a microcontroller 7 via a switching circuit 5 and a differential amplifier 6, and the variations degree of the terminal voltage of the batteries B1, B2, and B3 and the variations degree of the capacities are discriminated based on the measurement result. When the variations degree of the terminal voltage is large, a discharge circuit connected to the secondary battery in which the terminal voltage indicates a maximum value from among the batteries B1, B2, and B3 is kept on until the terminal voltage decreases to a set value. When the variations degree of the capacity is large, the discharge circuit is maintained to be off, regardless of the degree of dispersion of the terminal and voltage correction for prohibition is controlled.



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(54) VOLTAGE CORRECTION CIRCUIT OF SECONDARY BATTERY

(57)Abstract:

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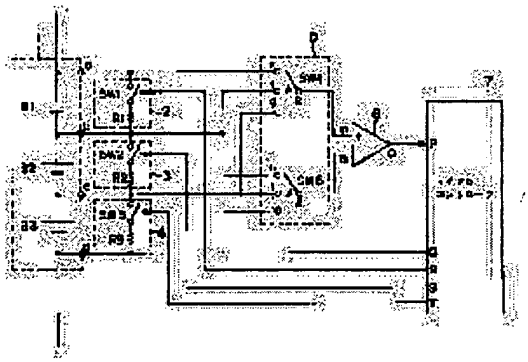

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] Having the following, said control means is (a). It is judged with a dispersion degree of said terminal voltage having exceeded the 1st set point with said 1st judgment means. And when a dispersion degree of said capacity is judged by said 2nd judgment means to be below the 2nd set point, Terminal voltage makes an ON state said discharge means connected to a rechargeable battery in which maximum is shown among said two or more rechargeable batteries. Voltage amendment of a rechargeable battery in which this maximum is shown by making this discharge means into an OFF state when this terminal voltage falls to a predetermined value is performed. (b) It is the voltage amendment circuit of a rechargeable battery characterized by maintaining said discharge means to an OFF state regardless of a judgment result of said 1st judgment means, and forbidding this voltage amendment when judged with a dispersion degree of said capacity having exceeded the 2nd set point with said 2nd judgment means. A discharge means which was connected to each both ends of two or more rechargeable batteries by which series connection was carried out and which can be turned on and off The 1st judgment means which judges a dispersion degree of terminal voltage of two or more of said rechargeable batteries as compared with the 1st set point The 2nd judgment means which judges a dispersion degree of capacity of two or more of said rechargeable batteries as compared with the 2nd set point A control means which controls said discharge means based on a judgment result of said 1st and 2nd judgment means
[Claim 2] Said discharge means is the voltage amendment circuit of a rechargeable battery according to claim 1 characterized by consisting of a switching device by which series connection was carried out to each both ends of two or more of said rechargeable batteries, and a resistance element.
[Claim 3] Said 1st judgment means is (a). A voltage difference of maximum of terminal voltage of two or more of said rechargeable batteries, and the minimum value, (b) A voltage difference of maximum of terminal voltage of two or more of said rechargeable batteries, and the average, (c) Two or more of said maximums of terminal voltage and terminal voltage of a rechargeable battery compare either and the 1st set point of a voltage difference with the average of terminal voltage of other rechargeable batteries except a rechargeable battery in which maximum is shown. A voltage amendment circuit of a rechargeable battery according to claim 1 characterized by judging a dispersion degree of said terminal voltage.
[Claim 4] Said 2nd judgment means sets a voltage difference of maximum of terminal voltage at the time of discharge termination of two or more of said rechargeable batteries, and the minimum value to Vc. When a value of Vc when not carrying out with a time of performing said voltage amendment on the occasion of charge of two or more of said rechargeable batteries is set to Vc1 and Vc2, respectively, A voltage amendment circuit of a rechargeable battery according to claim 1 characterized by judging a dispersion degree of said capacity for a value of Vc1-Vc2 as compared with the 2nd set point.
[Claim 5] For said control means, terminal voltage of a rechargeable battery connected to said discharge means in an ON state is (a). A time of falling to voltage of the minimum value of the terminal voltage of other rechargeable batteries, It is (c) a time of falling to voltage of the average of terminal voltage of a rechargeable battery besides (b). A voltage amendment circuit of a rechargeable battery given in claim 1 term characterized by making this discharge means into an OFF state at one at the time of falling to the average of terminal voltage of two or more of said rechargeable batteries of the times.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the voltage amendment circuit for amending dispersion in the terminal voltage of two or more rechargeable batteries by which were built over the voltage amendment circuit of a rechargeable battery, especially series connection was carried out.
[0002]
[Description of the Prior Art] When terminal voltage falls too much by discharge or neglect, or terminal voltage becomes high too much while charging reverse, the cell engine performance may deteriorate or, as for non-aqueous-solvent system rechargeable batteries and lead accumulators, such as a lithium secondary battery, safety may be spoiled. For this reason, in these rechargeable batteries, terminal voltage needed to be supervised, and charge and discharge needed to be controlled and used so that terminal voltage might become predetermined within the limits.
[0003] When in the case of a lithium secondary battery the copper of the charge collector currently used for the negative electrode if terminal voltage becomes less than [2V] begins to dissolve into the electrolytic solution, and the cell engine performance deteriorates and terminal voltage becomes it more than 4.5V especially, gas may occur by disassembly of the electrolytic solution, as a result, the pressure inside a cell may rise, a relief valve may operate, and it may spill liquid. Therefore, if the discharge current will be intercepted if the discharge prohibition voltage which terminal voltage fell and was beforehand set up when a lithium secondary battery was used is reached, terminal voltage rises and charge prohibition voltage is reached, it is common that it is made to perform charge and discharge through the protection network which has the function which intercepts charge. Discharge prohibition voltage is set as voltage [a little] (for example, 2.3V) higher than voltage 2V which the copper of a negative electrode begins to dissolve, and charge prohibition voltage is set as voltage [a little] (for example, 4.35V) lower than the voltage from which disassembly of the electrolytic solution begins.
[0004] Moreover, in the protection network of the conventional rechargeable battery, when series connection of two or more rechargeable batteries was carried out and they were used, each terminal voltage was detected and same protected operation was performed. That is, when they were used having carried out series connection of two or more rechargeable batteries, the method of protecting a rechargeable battery was taken by forbidding discharge, if terminal voltage is detected for every cell and the terminal voltage of one of cells reaches below discharge prohibition voltage, and forbidding charge, if the terminal voltage of one of cells reaches more than charge prohibition voltage.
[0005]
[Problem(s) to be Solved by the Invention] However, in the conventional protection network mentioned above, if the charge, the amount of self-discharge, and capacity of each rechargeable battery differ from each other when using them, carrying out series connection of two or more rechargeable batteries, the terminal voltage of a rechargeable battery will produce dispersion.
[0006] For this reason, at the time of discharge, the terminal voltage of a cell with few charges may fall earlier than the terminal voltage of other cells, discharge prohibition voltage may be reached, and discharge may stop the terminal voltage of a rechargeable battery as it is average sufficiently high. Moreover, at the time of charge, when a cell with many charges reaches reverse early at charge prohibition voltage, charge will be impossible to a full charge and a time will become short. Furthermore, when it is going to avoid such un-arranging, there is complicatedness that each cell must be used carrying out series connection after arranging each terminal voltage.
[0007] If the terminal voltage of the rechargeable battery used for a power supply falls, he transmits the data of volatile storage to nonvolatile storages, such as a hard disk, and is trying to prevent disappearance of data by the device which contains volatile storage, such as RAM, like a personal computer on the other hand. However, when the protection

network conventional by such device was used, after the terminal voltage of some [with many amounts of self-discharge] rechargeable batteries fell and reaching discharge prohibition voltage that there are few charges, discharge may intercept [the terminal voltage of a rechargeable battery] suddenly that it is average sufficiently high at the time, consequently there was a problem that the data of volatile storage will disappear.
[0008] This invention amends dispersion of the charge of two or more rechargeable batteries, or the amount of discharge by which series connection was carried out, and aims at offering the voltage amendment circuit of the rechargeable battery which can avoid un-arranging [which was mentioned above at the time of discharge and charge].
[0009]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it makes into a main point having made it this invention make a rechargeable battery discharge so that terminal voltage dispersion of two or more rechargeable batteries by which series connection was carried out may be searched for and this dispersion may be amended.
[0010] Namely, a voltage amendment circuit of a rechargeable battery concerning this invention A discharge means which was connected to each both ends of two or more rechargeable batteries by which series connection was carried out and which can be turned on and off, The 1st judgment means which judges a dispersion degree of terminal voltage of two or more rechargeable batteries as compared with the 1st set point, It has the 2nd judgment means which judges a dispersion degree of capacity of two or more rechargeable batteries as compared with the 2nd set point, and a control means which controls a discharge means based on a judgment result of the 1st and 2nd judgment means.
[0011] And a control means is (a). When it is judged with a dispersion degree of terminal voltage having exceeded the 1st set point with the 1st judgment means and a dispersion degree of capacity is judged by the 2nd judgment means to be below the 2nd set point, Terminal voltage makes an ON state a discharge means connected to a rechargeable battery in which maximum is shown among two or more rechargeable batteries. Voltage amendment of a rechargeable battery in which this maximum is shown by making this discharge means into an OFF state when this terminal voltage falls to a predetermined value is performed. (b) When judged with a dispersion degree of capacity having exceeded the 2nd set point with the 2nd judgment means, regardless of a judgment result of the 1st judgment means, a discharge means is maintained to an OFF state, and this voltage amendment is forbidden.
[0012] Thus, in a voltage amendment circuit of a rechargeable battery by this invention constituted, when terminal voltage of two or more rechargeable batteries by which series connection was carried out produces dispersion by a certain cause, dispersion becomes large, and terminal voltage makes a rechargeable battery in which maximum is shown discharge, reduces the terminal voltage to terminal voltage of other rechargeable batteries, and voltage of abbreviation identitas and performs voltage amendment, dispersion in terminal voltage can be made small. That is, dispersion in terminal voltage of a rechargeable battery by difference in a charge or the amount of self-discharge is amended.
[0013] Moreover, in this voltage amendment circuit, even when dispersion in terminal voltage is large, when dispersion in capacity is large, a rechargeable battery is not discharged, but voltage amendment is forbidden. By carrying out like this, discharge is not intercepted for terminal voltage in spite of a condition high on the average at the time of discharge.

[0014] Namely, since there is orientation which will serve as overdischarge as compared with a rechargeable battery with much capacity to a rechargeable battery with little capacity at the time of a surcharge and discharge at the time of charge if dispersion in capacity of a rechargeable battery becomes large, if voltage amendment works, a rechargeable battery with little capacity will be made to discharge, and it will become overdischarge further at the time of discharge. Consequently, if the above voltage amendments are performed simply, at the time of discharge, discharge is intercepted as it is high on the average, and terminal voltage may serve as an opposite effect on the contrary. So, in this invention, when dispersion in capacity is large, such evil is prevented by forbidding voltage amendment.
[0015] Therefore, when using a rechargeable battery as a power supply of a device which transmits data of volatile storage to a nonvolatile storage, and prevents disappearance of data, and terminal voltage of some rechargeable batteries falls early and reaches discharge prohibition voltage, discharge does not intercept suddenly and data of volatile storage is certainly saved [if volatile storage is built in like a personal computer and terminal voltage of a rechargeable battery falls,].
[0016] On the other hand, since all rechargeable batteries are equally charged at the time of charge, charge is ensured to a full charge and a time becomes long. And after arranging terminal voltage of two or more rechargeable batteries like before, complicated time and effort of carrying out series connection becomes unnecessary.
[0017] In this invention, a discharge means is constituted by a switching device and a resistance element by which series connection was carried out to each both ends of two or more rechargeable batteries, and when a control means turns on/controls [off] a switching device, ON/OFF of a discharge condition are performed.

[0018] Moreover, the 1st judgment means in this invention is specifically (a). A voltage difference of maximum of terminal voltage of two or more rechargeable batteries, and the minimum value, (b) A voltage difference of maximum of terminal voltage of two or more rechargeable batteries, and the average, (c) When two or more maximums of terminal voltage and terminal voltage of a rechargeable battery compare either and the 1st set point of a voltage difference with the average of terminal voltage of other rechargeable batteries except a rechargeable battery in which maximum is shown, a dispersion degree of terminal voltage is judged.
[0019] Moreover, the 2nd judgment means in this invention sets a voltage difference of maximum of terminal voltage at the time of discharge termination of two or more concrete for example, rechargeable batteries, and the minimum value to Vc. When a value of Vc when not carrying out with a time of performing voltage amendment on the occasion of charge of two or more rechargeable batteries is set to Vc1 and Vc2, respectively, a dispersion degree of capacity is judged by comparing a value of Vc1-Vc2 with the 2nd set point.
[0020] Furthermore, for a control means in this invention, terminal voltage of a rechargeable battery connected to a discharge means in an ON state is (a). It is (b) a time of falling to voltage of the minimum value of the terminal voltage of other rechargeable batteries. Let the discharge means be an OFF state at one at the time of falling to the average of terminal voltage of a rechargeable battery of (c) plurality of the times a time of falling to voltage of the average of terminal voltage of other rechargeable batteries.
[0021] However, when voltage of both ends as for which two or more rechargeable batteries carried out series connection is below a predetermined value, or when maximum of terminal voltage of two or more rechargeable batteries is below a predetermined value, it is desirable that it is made not to make a discharge means into an ON state.
[0022]
[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained with reference to a drawing. Drawing 1 is the block diagram showing the voltage amendment circuit of the rechargeable battery concerning 1 operation gestalt of this invention. In this drawing, the rechargeable battery group 1 carries out series connection of the rechargeable battery [two or more (this example three pieces)] B1, B-2, and B3, and is constituted. + terminal of a rechargeable battery B1 -- the external end-connection child a - terminal of rechargeable battery B-2 and + terminal of a rechargeable battery B3 are connected to the external end-connection child c, and - terminal of a rechargeable battery B3 is connected to the external end-connection child b for - terminal of a rechargeable battery B1, and + terminal of rechargeable battery B-2 at the external end-connection child d, respectively.
[0023] A switching device, and R1, R2 and R3 are resistance for discharge, and SW1, SW2, and SW3 constitute the 1st discharge circuit 2 from a switching device SW1 and resistance R1, they constitute the 2nd discharge circuit 3 from a switching device SW2 and resistance R2, and constitute the 3rd discharge circuit 4 from a switching device SW3 and resistance R3. The both ends of the 2nd discharge circuit 3 are connected to the external end-connection children b and c of the rechargeable battery group 1, and the both ends of the 3rd discharge circuit 4 are connected to the external end-connection children a and b of the rechargeable battery group 1 for the both ends of the 1st discharge circuit 2 at the external end-connection children c and d of the rechargeable battery group 1, respectively.
[0024] An electronic switch 5 consists of the 1st circuit changing switch SW4 which consists of transfer contacts e, f, and g and a contact common k, and the 2nd circuit changing switch SW5 which consists of transfer contacts h, i, and j and a contact common l, and switches SW4 and SW5 are interlocking. That is, when a contact common l is changed to a transfer contact i when a contact common l is changed to a transfer contact h when a contact common k is changed to a transfer contact e, and a contact common k is changed to a transfer contact f, and a contact common k is changed to a transfer contact g, a contact common l is changed to a transfer contact j. And the transfer contacts e, f, and g of the 1st circuit changing switch SW4 of an electronic switch 5 are connected to the terminals a, b, and c of the rechargeable battery group 1, respectively, and the transfer contacts h, i, and j of the 2nd circuit changing switch SW5 are connected to the terminals b, c, and d of the rechargeable battery group 1, respectively.
[0025] The common terminals k and l of the 1st and 2nd circuit changing switches SW4 and SW5 of an electronic switch 5 are connected to the input terminals m and n of the differential amplifier 6, respectively. The differential amplifier 6 consists of an operational amplifier A and two or more resistance, and generates the voltage equivalent to the voltage difference between input terminals m and n in an output terminal O. The rechargeable battery B1 in the rechargeable battery group 1, B-2, and the amplitude-measurement circuit that measures each terminal voltage of B3 are constituted by these electronic switches 5 and the differential amplifier 6.
[0026] The output terminal O of the differential amplifier 6 is connected to the input terminal P of a microcontroller 7. The microcontroller 7 contains the A/D converter and changes into digital value the output voltage of the differential amplifier 6 inputted into an input terminal P by this A/D converter. The 1st judgment which judges the degree of dispersion in the rechargeable battery B1 measured by the electronic switch 5, the differential amplifier 6, and the A/D

converter, B-2, and the terminal voltage of B3 by software processing by the program inside a microcontroller 7 from the digital value obtained by this A/D converter as compared with the 1st set point, and the 2nd judgment which judges a rechargeable battery B1, B-2, and the dispersion degree of the capacity of B3 as compared with the 2nd set point are performed.

[0027] A microcontroller 7 outputs the control signal for choosing the transfer contact of a circuit changing switch 5 from an output terminal Q. By the control signal from this output terminal Q, common terminals k and l are changed to transfer contacts e and h, transfer contacts f and i, and transfer contacts g and j one by one.

[0028] Furthermore, a microcontroller 7 performs ON/OFF control of the switches SW1, SW2, and SW3 of the discharge circuits 2, 3, and 4 based on the above 1st and the 2nd judgment result. That is, the microcontroller 7 is equipped with three more output terminals R, S, and T, carries out ON/OFF control of the switching device SW1 of the discharge circuit 2 through an output terminal R, carries out ON/OFF control of the switching device SW2 of the discharge circuit 3 through an output terminal S, and carries out ON/OFF control of the switching device SW3 of the discharge circuit 4 through an output terminal T.

[0029] Next, actuation of the voltage amendment circuit of the rechargeable battery of drawing 1 constituted in this way is explained using the flow chart of drawing 2 . Initiation of charge detects a rechargeable battery B1, B-2, and the terminal voltage of B3 (step S10). In this case, the switches SW4 and SW5 of an electronic switch 5 choose a rechargeable battery B1 by control from a microcontroller 7, and the differential amplifier 6 generates the voltage equivalent to the terminal voltage of a rechargeable battery B1. After the output voltage of this differential amplifier 6 is inputted into the input terminal P of a microcontroller 7 and is changed into digital value by the A/D converter, it is memorized by memory. Hereafter, similarly, the switches SW4 and SW5 of an electronic switch 5 make sequential selection of rechargeable battery B-2 and B3, and after the output voltage of the differential amplifier 6 at that time is inputted into a microcontroller 7 and changed into digital value, they are memorized by memory.

[0030] In this way, if all of a rechargeable battery B1, B-2, and the terminal voltage of B3 are memorized by memory as digital value, the judgment of the 1st judgment, B1 [i.e.,], B-2, and the dispersion degree of the terminal voltage of B3 will be performed next (step S11). Namely, the rechargeable battery B1 memorized by memory at step S11, B-2, and maximum Vmax of the terminal voltage of B3 Minimum value Vmin It asks and the size comparison of both difference, i.e., the dispersion degree of terminal voltage, is carried out with the 1st set point Va. Here, there is almost no difference of a rechargeable battery B1, B-2, and the terminal voltage of B3, since it is Vmax-Vmin <=Va (it is NO at step S11), it returns to step S10 and detection of terminal voltage is usually continued.

[0031] On the other hand, if a rechargeable battery B1, B-2, and big dispersion to the terminal voltage of B3 occur by the difference between a certain cause, for example, a charge, and the amount of self-discharge, it will be set to Vmax-Vmin >Va (it is YES at step S11), it will progress to step S12 in this case, and the judgment of the 2nd judgment, B1 [i.e.,], B-2, and the dispersion degree of the capacity of B3 will be performed. That is, at step S12, the size comparison of the difference of Vc1 and Vc2 by which storage maintenance was carried out beforehand at memory is carried out with the 2nd set point Vb. However, Vc: Vmax-Vmin at the time of discharge termination Value Vc1: On the occasion of charge, on the occasion of value Vc2:charge of Vc when voltage amendment is performed, it is the value of Vc when voltage amendment is not performed, and Vc1-Vc2 expresses a rechargeable battery B1, B-2, and the dispersion degree of the capacity of B3.

[0032] Since a rechargeable battery B1, B-2, and the capacity of B3 are usually almost the same, here If voltage amendment mentioned later is performed, B1, B-2, and each charge of B3 are adjusted, and since it is small as compared with the time of voltage amendment not being performed for dispersion in the terminal voltage at the time of discharge, either, discharge will not be intercepted for B1, B-2, and the terminal voltage of B3 at the time of discharge as it is high on the average.

[0033] On the other hand, since there is orientation which will serve as overdischarge as compared with a rechargeable battery with much capacity to the rechargeable battery with little capacity at the time of a surcharge and discharge at the time of charge if dispersion in a rechargeable battery B1, B-2, and the capacity of B3 becomes large, if voltage amendment is performed, a rechargeable battery with little capacity will be made to discharge, and it will become overdischarge further at the time of discharge. Consequently, if voltage amendment is performed, at the time of discharge, discharge is intercepted for a rechargeable battery B1, B-2, and the terminal voltage of B3 as it is high on the average, and voltage amendment actuation may serve as an opposite effect.

[0034] Then, dispersion in a rechargeable battery B1, B-2, and the capacity of B3 is small, when it is Vc1-Vc2 <=Vb (it is NO at step S12), it progresses to step S13 and voltage amendment is performed, but when dispersion in capacity is Vc1-Vc2>Vb greatly (it is YES at step S12), voltage amendment is not performed, but it returns to step S10, and detection of terminal voltage is continued. If it does in this way, when dispersion in capacity is large, the above evils by

performing voltage amendment can be avoided.
[0035] In voltage amendment of step S13, a rechargeable battery B1, B-2, and among B3, when discharge of that rechargeable battery is made to start by having made into ON condition the switch of the discharge circuit connected to the cell which terminal voltage shows maximum and this terminal voltage falls to the minimum value of a rechargeable battery B1, B-2, and the terminal voltage of B3, discharge is terminated by making that switch into an OFF condition.
[0036] Thus, in this invention, even if dispersion arises by a certain cause, when two or more rechargeable batteries B1 which carried out series connection, B-2, and the terminal voltage of B3 make the rechargeable battery in which the greatest terminal voltage is shown discharge, lower terminal voltage and perform voltage amendment, dispersion in terminal voltage can be made small.
[0037] Moreover, in this invention, especially, when dispersion in a rechargeable battery B1, B-2, and the capacity of B3 is large, the evil of the voltage amendment in such a case can be avoided by forbidding voltage amendment as dispersion in terminal voltage is large.
[0038] This invention is not limited to the above-mentioned operation gestalt, can deform variously as follows and can be carried out.
(1) Although the example which carried out three-piece series connection explained the rechargeable battery with the above-mentioned operation gestalt, also when series connection of two pieces or the four rechargeable batteries or more is carried out, the voltage amendment circuit of this invention can be applied.
[0039] (2) Although the voltage difference of maximum and the minimum value was searched for as two or more rechargeable batteries B1, B-2, and a dispersion degree of the terminal voltage of B3 and this was compared with the 1st set point with the above-mentioned operation gestalt, in quest of the voltage difference of maximum and the average, or the voltage difference of maximum and the average of other terminal voltage except maximum, you may compare with the 1st set point as a dispersion degree of terminal voltage.
[0040] (3) If it falls even to the average of the terminal voltage of all rechargeable batteries, or the average of the terminal voltage of the rechargeable battery (namely, rechargeable battery which omits voltage amendment) except the rechargeable battery which terminal voltage showed maximum, you may make it suspend discharge, although it was made to make the rechargeable battery which terminal voltage shows maximum on the occasion of voltage amendment discharge with the above-mentioned operation gestalt until terminal voltage turned into terminal voltage of the cell in which the minimum value is shown.
[0041] (4) Since terminal voltage may not be stabilized immediately after charge initiation, you may make it fixed time amount forbid monitor actuation of terminal voltage from charge initiation with the above-mentioned operation gestalt, although only the terminal voltage under charge is supervised.
[0042] (5) With the above-mentioned operation gestalt, when voltage amendment was performed at the time of charge, it carried out just and explained, but this invention can be applied also when carrying out voltage amendment to the time of discharge, or relaxation time. In addition, in the range which does not deviate from a summary, it deforms variously and this invention can be carried out.
[0043]
[Effect of the Invention] As explained above, when the terminal voltage of two or more rechargeable batteries by which series connection was carried out produces dispersion by a certain cause according to this invention, dispersion in terminal voltage can be small suppressed by making the rechargeable battery in which the greatest terminal voltage is shown discharge, making it fall to the almost same voltage as the terminal voltage of other rechargeable batteries, and performing voltage amendment. That is, even if there is dispersion in a charge or the amount of self-discharge, they can be amended automatically.
[0044] Furthermore, when dispersion in the capacity of two or more rechargeable batteries is large By having been made not to perform voltage amendment as dispersion in terminal voltage being large A rechargeable battery with little capacity is made to discharge by voltage amendment. Keep as overdischarge or Dispersion in the terminal voltage at the time of charge cannot be enlarged by voltage amendment at reverse, and terminal voltage can avoid evil from which discharge is intercepted as it is high on the average, and voltage amendment serves as an opposite effect by this.
[0045] Therefore, at the time of discharge, since discharge is not intercepted in the condition high on the average, the terminal voltage of a rechargeable battery In the case of a device which transmits the data of volatile storage to a nonvolatile storage, and prevents disappearance of data when the terminal voltage of the rechargeable battery which is a power supply like a personal computer falls The terminal voltage of some rechargeable batteries falls early, and reaches discharge prohibition voltage, and it becomes possible to avoid disappearance of the data of the volatile storage by discharge intercepting suddenly.
[0046] On the other hand, at the time of charge of two or more rechargeable batteries, since all rechargeable batteries

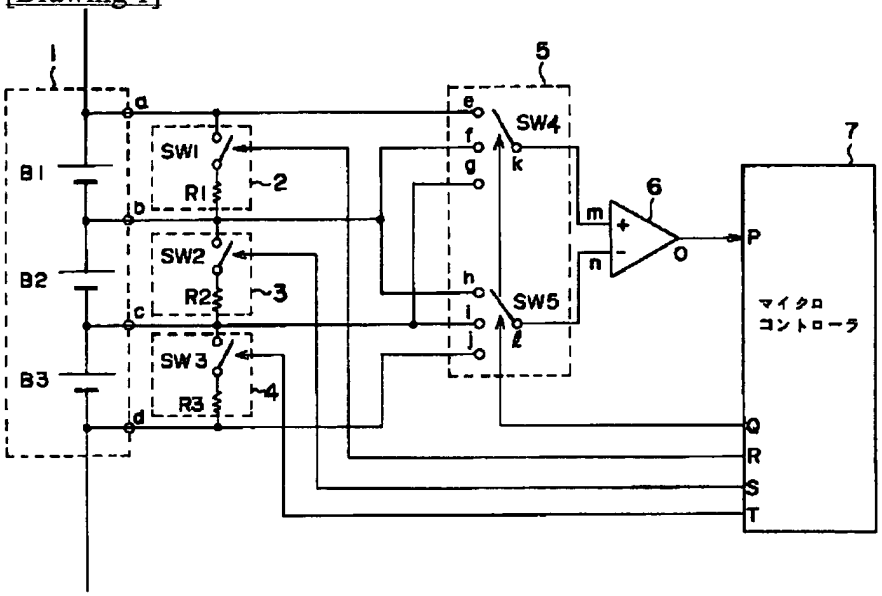
are charged equally, charge can be ensured to a full charge, the time as the whole rechargeable battery can be lengthened, and after arranging the terminal voltage of two or more rechargeable batteries still like before, the complicated time and effort of carrying out series connection becomes unnecessary.

[Translation done.]

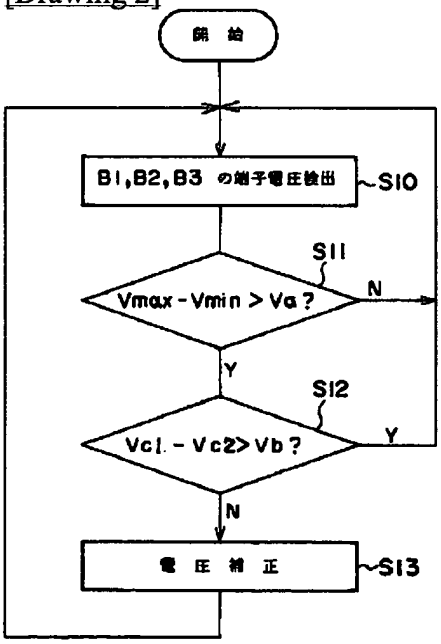
* NOTICES *

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]